The Mysore Agricultural Journal

(The Journal of the Mysore Farmers' Forum)

Vol. XXXIII] January—March 1958 [No. 1

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IN THIS ISSUE

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COW DUNG GAS PLANT

SOME FINDINGS ON THE NUTRITION OF SUGARCANE CROP IN MALNAD TRACT

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The
Mysore Agricultural Journal

The Journal of the Mysore Farmers' Forum

Vol. XXXIII *January to March 1958* *No. 1*

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Editorial

"IF OTHERS CAN WHY NOT WE?"

INCREASED food production has been a matter engaging serious attention of all those interested in the progress of the country. Time and again the question is being discussed on platforms, in Seminars, in papers, in legislatures, political party meetings and what not. On all such occasions it is emphatically stated by some at least that it is possible to increase food production by cent per cent. Examples of Japan, United States, China and other countries are freely quoted and it is stated "If others can do it why not we?" Visiting experts of other countries are also of the opinion that the present level of production is very low and that there is vast scope for increasing the same.

It is true that Japan has increased the production of Wheat four-fold. United States has increased the production of Maize although the area under this crop is reduced. In recent years China has increased the agricultural output to a very great extent. If the reasons for bringing about such increase in the production are analysed dispassionately it would be clear that it is not the size of holding that is important nor the ideologies but the following are the main reasons for such an increase in the production in other countries:—

(1) The Farmers' requisites are made available at a reasonable rate as, where and when they are required. The credit facilities are available for purchasing his requirements.

(2) The Technical "Know How" is made available to the Farmers on the spot as and when required.

(3) The Producer is assured of a certain minimum price.

(4) Hard work is put in by all concerned.

This shows that the question is not whether the production can be increased or not but how best the means stated above could be provided to achieve the object set forth.

Original Articles

A SHORT NOTE ON THE BANANA LEAF THRIPS—*CALIOTHRIPS* (=*HELIOTHRIPS*) *KADALIPHILA* RAMKR. M.

By D. V. Murthy*

Introduction

Banana (*Musa paradisca*) is a common fruit crop grown all over the Mysore State. It is generally not prone to attack of serious insect pests although the stem weevil (*Cosmopolites sordidus*) does appreciable damage at times. Amongst the leaf-sucking insects a tingid bug (awaiting identification) and the leaf thrips—*Caliothrips* (= *heliothrips*) *kadaliphila* Ramkr. M. are important. Although economically not very important, at times the above insects are known to cause some damage to young plants. This note deals in brief with the Banana leaf thrips.

Description of the Insect

Ayyar and Margabandhu (1930) have described this species in detail. The female is larger in size than the male and measures 1·4 mm. in length. General colour is dark to yellowish or reddish brown; eyes black, ocelli with pinkish pigment; wings are uniformly yellowish-grey in colour.

Head is broader than long; the surface of the head is clearly reticulated; the antenna 8-jointed and is twice as long as the head.

Abdomen is long and blunt apically; there are two pairs of short tubercular spines situated on each side of the median line, the anterior pair stouter and longer than the hind pair.

The ovipositor in the female is long. The macropterous male of the species measures 1·1 mm. in length.

Distribution

This insect appears to have a wide distribution all over South India. Ayyar and Margabandhu (*loc. cit.*) described the species from specimens collected from Coimbatore in Madras State. Ananthakrishnan (1957) reports that it is common in all Banana Plantations and that he had collected hundreds of them in Kodaikanal. In Mysore State the writer has collected the specimens from Bangalore, Mandya, Mysore and Dharwar districts and presumably it occurs in all the districts of the State.

---

* Assistant Entomologist, Department of Agriculture, Bangalore.

Nature of Damage

The insect is invariably found on the under-surface of the Banana leaves. In the beginning of the attack a random patch is selected underneath the leaf wherein both the adults and nymphs congregate and lacerate the leaves by puncturing the soft tissue and sucking up the fluid. At first such affected patches show a blighted appearance when held against the light. It later on turns into pale yellow colour. In case of severe infestation these patches become brownish and the entire leaf starts drying up. When the affected patches are examined under a hand-lens innumerable number of this species of thrips could be made out. In one instance, in an affected leaf of a *Rasabale* plant in the Laboratory compound as many as 57 adults and nymphs were counted.

Brief Notes on Bionomics and Seasonal History

Eggs are laid by the female inside the leaf tissue, the nymphs hatching out in 4–6 days' time. The freshly hatched nymph is pale yellow in colour without wings; it however is able to move briskly on the leaf. In all, the insect undergoes 3 to 4 moults including the pre-pupal stage. All the development stages are passed on the under-surface of the leaf itself. During the third moult the wing pads are found to appear and the nymph turns into brown colour. The nymph carries a large globule of fæces at the end of the body.

The life-history studies conducted in the Insectary at the prevailing temperatures 70–84° during October–November 1957 show that the entire life-history is completed in 9–12 days as shown in Table I.

Table I

Culture No.	Date of hatching	Date of reaching adult stage	No. of days taken from hatching to maturity
1	29–10–1957	9–11–1957	11 days
2	1–11–1957	10–11–1957	9 days
3	2–11–1957	14–11–1957	12 days

There appears to be a number of overlapping generations, all stages of the insect being found at one and the same time. It is also observed all the year round. The intensity of attack is however found greater during the South-West Monsoon months of June–September.

ACKNOWLEDGEMENTS

I am grateful to Dr. M. Puttarudriah, Government Entomologist, for his keen interest and encouragement. My thanks are also due to Sri. T. N. Ananthakrishnan, Professor of Zoology, Loyola College, Madras, for identification of the species.

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(Received: 10th April 1958)

(*In Queensland, another species of thrips* Scirothrips signipennis *Bagn.* (Chætanaphothrips orchidii) *commonly termed as "rust thrips" is known to cause enormous loss by feeding on the peel of the Banana fruits.*—EDITORS.)

POWDERY MILDEW ON SOME NEW HOSTS IN MYSORE

By N. S. Venkatakrishniah*

The destructive nature of the powdery mildews occurring on several plants, especially on cultivated fruits, vegetables and ornamentals, is very well known. There are numerous reports of the occurrence of the obligate parasite on several hosts in India. The pathogen which occurs extensively in its conidial stage produce rarely its perfect stage in South India. In Mysore the perfect stage of *Erysiphe polygoni* DC. was observed by the writer[1] (1951) on peas (*Pisum sativum* L.) cultivated in fields near Bangalore. The cleistothecial stage was also observed by the writer[2] (1955) in November 1955 of the powdery mildew *Uncinula* Sp. occurring on the leaves of *Ficus religiosa* L. which were growing in the vicinity of betel vines (*Piper betle* L.) affected by powdery mildew in a garden near Bangalore. Venkatarayan and Delvi[3] (1953) record the occurrence of *Leveillula taurica* (Lev.) Arn., on *Solanum torvum* Swartz, in Mysore.

In a further search for the cleistothecial stages of the several powdery mildews occurring in Mysore, a number of host plants affected heavily by the obligate parasite were collected during the years 1955 and 1956 and a preliminary study was made of the conidial stage of the fungus occurring on some of them. There appears to be no record of the prevalence of the parasite on some of these hosts in Mysore. A list of some of these new hosts with dimensions of Conidia and Conidiophores of the pathogen is given in Table I.

The other hosts that are heavily infected by powdery mildew in Mysore are *Antigonon leptopus*, *Argemone mexicana* Linn., *Bronssonetia papyrifera*, *Euphorbia prostrata* Ait, *Mirabilis jalapa*, *Phaseolus radiatus*, *Phyllanthus niruri*, *Santalum album*, and *Sesamum indicum*.

A detailed note of the work giving the causal organism categorically against each host will be shortly published.

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(Received: 16th April 1958)

* Plant Pathologist, Department of Agriculture, Bangalore.

TABLE I

No.	Hosts	Locality	Date of Collection	Conidiophores in μ			Conidia in μ		
				Range		Average	Range		Average
				Length	Width	L × W	Length	Width	L × W
1	*Ægle marmelos* Corr. ..	Bangalore	August 1956	44—80	8—10	55·84×12·8	22—40	14—16	34·24×23·28
2	*Apium graveolens* Linn.	do.	November 1955	72-104	6—12	89·76× 9·2	28—40	12—18	34·72×15·6
3	*Cajanus cajan* (L.) Millsp.	do.	December 1955	40-112	6— 8	81· 6× 7·6	30—46	12—20	37·12×16·48
4	*Carica papaya* Linn. ..	do.	August 1956	44—72	8—10	55·76× 6	32—46	14—18	38·24×16·08
5	*Chrysanthemum indicum* Linn.	do.	November 1955	72-200	10—12	120·32×10·96	26—42	10—18	34·48×15·44
6	*Croton bonplandianum* (L.) Croizat	Channapatna	November 1955	64-216	10—12	149·48×11·92	28—33	14—20	30·08×16·32
7	*Cucurbita melo-pepo* ..	Bangalore	November 1956	64-120	8—14	98·08×12	24—36	12—18	30×17·12
8	*Dolichos lab-lab* var. *typicum* Prain.	Hassan	January 1955	36-164	8—12	103·2 × 8·72	56—92	16—24	69·44×20·16
9	*Euphorbia geniculata* Orteg.	Bangalore	December 1955	160-272	6— 8	227·2 × 6·8	52—76	16—18	62·08×16·24
10	*Euphorbia hirta* Linn.	do.	December 1955	96-184	12—16	143·12×12·48	28—36	12—18	31·44×15·6
11	*Heliotropium indicum* Linn.	do.	December 1955	32-140	10—12	100·48×11·36	24—34	12—20	30×16·56
12	*Leucas aspera* Spr.	Hassan	January 1955	64-104	9—12	87·28×10·64	28—34	12—16	30·56×15·2
13	*Ocimum sanctum* Linn.	Bangalore	January 1955	56-120	10—12	90·08×11·6	30—40	14—20	34·24×16·56
14	*Parkinsonia aculeata* Linn.	do.	January 1955	56-122	8—	86·×8	24—44	8—16	35·2 ×13·76
15	*Ricinus communis* Linn.	do.	September 1956	68—94	8—12	130·× 9·36	26—42	12—14	31·44×13·36
16	*Tamarindus indica* Linn.	do.	December 1955	44—72	6— 9	59·04×8	26—38	12—18	31·76×15·12

OCCURRENCE OF IMMATURITY OF SEEDS IN DESHI COTTONS IN KARNATAK

By U. K. Kanitkar[1] and S. H. Kathavate[2]

Introduction

Eastern part of Karnatak experienced very severe weather conditions during February, March and April 1957. This period was characterised by very low aerial humidity and unprecedented high wind for this part of the year. It resulted in bad opening of bolls in the American cotton—*Laxmi*. Other American cottons were also affected during this season to a greater or lesser extent.

More than 90% of the bolls in *Laxmi* cotton in Gadag were found to have opened badly with extremely immature seed and lint. This resulted in reduction of yield of *Laxmi* to 50 lb. per acre as compared with an average of about 200 lbs. per acre in a normal year. In Bagalkot also *Laxmi* behaved in a similar way.

The boll period of *Laxmi* was found to have reduced from an average of 60 days in a normal year to an average of 45 days in 1956–57 season. Normally an earlier part of 28 to 30 days out of the boll period is characterised by an enlargement of boll and elongation of fibre in *Laxmi* as in most of the cottons generally. During the latter period of about 30 days maturation of the fibre takes place involving deposition of carbohydrates inside the fibre and their reduction to cellulose. This goes on hand in hand with deposition of reserve in the seed and its maturation. If bolls open prematurely in 45 days from setting, it results in exposure of seed which is poorly developed and fibre with inadequate deposition of carbohydrates. This naturally results in lesser weight of lint per boll, lesser fibre weight, lesser strength and drastic reduction in spinning value which renders the lint useless.

In 1956–57, the amount of kapas obtained per boll in *Laxmi* on an average was about 1·2 gm. as against 2·7 to 2·8 gm. in a normal year. Even though the weight of lint was less as compared to a normal year, the seeds were so poorly developed, that it showed a false increase in ginning percentage which sometimes was as high as 50%.

Results

It was considered worthwhile to examine if the Asiatic cottons, namely, *Jayadhar* and other strains being developed at the Kumta

[1, 2] Plant Physiologist and Research Assistant, Agricultural College, Dharwar, repectively.

Cotton Improvement Farm, Bagalkot, also behaved in the same manner. The testing was done in an experiment in which the strains including *Jayadhar* and K.F.T. 12–2–5 were being compared, in 1955–56 and 1956–57 seasons. The lint obtained was sent to the Technological Assistant, Dharwar, for fibre test and to the Technological Laboratory, Matunga, for Micro spinning tests.

Results

The results obtained in this trial are given below:—

Table I

Ginning Percentage and Fibre Characters of the Strains being Built at Bagalkot and Brought from Outside

Name of strains	Year of trial	Ginning %	Fibre length in inches	Fibre wt. per inch 10–6 oz.	Count strength product corrected to nominal 30's	Weight of 100 seeds
1	2	3	4	5	6	7
B.C. 1 ..	1955—56	27·5	0·92	0·150	1818	6·44
	1956—57	28·3	0·83	0·167	1499	5·40
15—39 × ..	1955—56	29·0	0·92	0·161	1836	..
	1956—57	29·9	0·85	0·128	1508	6·29
16 × ..	1955—56	27·8	0·91	0·127	1894	..
	1956—57	30·0	0·87	0·137	1519	6·20
15—3—3 ..	1955—56	27·5	0·93	0·168	1641	6·46
	1956—57	29·0	0·81	0·158	1331	5·74
15—3—6 ..	1955—56	30·0	0·92	0·181	1445	6·74
	1956—57	31·6	0·87	0·152	1606	6·15
E—22 ..	1955—56	35·2	0·85	0·134	..	..
	1956—57	37·5	0·84	0·148	1306	7·30
77—2 ..	1955—56	34·3	1·01	0·148	..	..
	1956—57	37·2	0·88	0·183	1302	6·70
Jayadhar ..	1955—56	27·8	0·93	0·167	1799	6·28
	1956—57	29·6	0·86	0·157	1317	6·08
K.F.T. 12—2—5 ..	1955—56	23·7	0·89	0·137	1949	..
	1956—57	24·5	0·86	0·153	1616	5·85

Out of the above strains B.C. 1 is evolved from (*Jayadhar* × *Suyog*) K.F.T. 12–2–5, while 15–39 ×, 61 ×, 5–3–3 and 15–3–6 are evolved from (K.F.T. × S. 8) and (K.F.T. × S. 8) K.F.T.

Discussion

B.C. 1 and *Jayadhar* have shown an increase in ginning percentage by about 0·8 and 1·8% respectively. A considerable decrease in fibre length has been observed in 1956–57. The fibre weight has shown an increase in B.C. 1 but a decrease in *Jayadhar*. In both the cases the count strength product is drastically reduced in 1956–57.

In the K.F.T. group, K.F.T. 12–2–5 itself has not shown any change in fibre length but a distinct increase in ginning percentage and fibre weight. The other K.F.T. materials although variable in respect of fibre weight per inch, show a distinct decrease in length of fibre, in each case bringing down the length to the normal level of 0·85 to 0·87 inches from the higher level of fibre length—characteristic of the improved strains. The ginning percentage is increased, the increase being higher to the extent of 2–2% in 16 ×, about 1·5% in 15–3–3 and 15–3–6 and only 0·9% in 15–39 ×.

The fibre weight figures show a considerable increase in K.F.T., while a similar increase, but of a lower order, occurred in 16 ×. In other cases there is a decrease in fibre weight, the highest decrease being in 15–39 × and 15–3–6 while 15–3–3 shows a relatively less reduction in fibre weight.

E. 22 and 77–2 are herbaceum strains obtained from Gujarath.

Though E. 22 does not show any change in the fibre length 77–2 is distinctly affected in this respect. In both of them ginning percentage shows increase while the fibre weight shows increase which is higher in 77–2 as compared to E. 22. The count strength product value shows a marked change from 1955–56 season to 1956–57 season. This count strength product values of all the strains have been found to be decreased by more than 300 units except in 15–3–6 where a slight increase in count strength product has been noted.

Hardness of Seeds

The kapas was also examined from the point of view of hardness of seeds in 50 locks, the results of which are given in Table II.

The data given in Table II is obtained by examining 50 random locks in the kapas obtained in various strains. It is seen that the amount of immaturity as judged by softness of seed, is low in all the strains. It is particularly low in *Jayadhar* and B.C. 1 though K.F.T. 12–2–5 is similar to B.C. 1 and *Jayadhar* in this respect. 16 ×, 15–39 × and 15–3–6 show at least some seeds which are soft. 15–3–3 has negligible percentage of soft seeds.

Out of the Gujarath strains, 77–2 had the largest percentage of soft seeds while E–22 was not affected so highly in this respect.

TABLE II

Name of strain	No. of seeds per lock	No. of hard seeds per lock	No. of soft seeds per lock	Percentage of soft seeds per lock
1	2	3	4	5
B.C. 1 ..	6·16	6·08	0·08	1·3
15—39× ..	6·34	6·28	0·06	0·94
16× ..	6·14	5·98	0·16	2·60
15—3—3 ..	6·26	6·24	0·02	0·31
15—3—6 ..	5·94	5·78	0·16	2·60
E—22 ..	6·28	6·20	0·08	1·20
77—2 ..	6·64	6·24	0·40	6·00
Jayadhar ..	6·96	6·94	0·02	0·28
K.F.T. 12—2—5 ..	6·10	6·08	0·02	0·32

In the course of maturation of kapas the fibre weight tends to decrease towards the final phase of maturation. In the year 1955–56 this maturation has been more complete as indicated by the low weight of fibre per inch as compared with 1956–57 season. This has particularly affected the count strength product value in almost all strains and is appreciably low in 1956–57 as compared with 1955–56. In the case of seed even though maturity as judged by hardness of seed is not affected appreciably, it is affected as shown by weight of 100 seeds. This shows that both lint and seed were not completely matured when the bolls opened, though the immaturity was not so pronounced as in *Laxmi.*

CONCLUSION

It is generally considered that the *Deshi* cottons are not effected by bad opening, *i.e.*, immaturity of seed and lint. It seems that in the light of the above observations, the statement requires a slight modification. The *Deshi* cottons are effected by immaturity but to a much lesser extent than American cottons like *Laxmi.*

(Received: 5th February 1958)

SOME OBSERVATIONS ON *TETTIGELLA SPECTRA* (DISTANT) ON PADDY IN MYSORE

By K. S. Siva Shankara Sastry*

Misra (1913) has recorded the occurrence of *Tettigella spectra* (Distant) along with *Nephotettix bipunctatus* Fabricius, and *Nephotettix apicalis* Motsch. on paddy in Bihar, Orissa and Central Provinces, etc. In Madras the Insect has been commonly referred to as White Jassid of paddy. In Mysore the insect was first noted in large numbers on paddy in Mandya District in 1954, and in Ganesha Farm, near Bangalore, in 1956. In the latter place it was seen heavily infesting the nurseries, along with two other Jassids *Nephotettix* sp., and *Deltocephalus* sp., resulting in the young seedlings looking pale, seared out and stunted. It has been noted now in several places in Bangalore and Kolar Districts.

The insect tallies with the mounted, named specimens of the species received from Coimbatore, and was also identified by the British Museum as *T. spectra* (Dist.). It also resembles another Jassid bigger in size and conspicuously green in colour, identified by U.S.D.A. as *T. spectra* (Dist.) [*Current Science*, **26,** 4: 122–123). Both these varieties, the white and the green, are found on sugarcane but the latter is not seen on paddy in nature.

The White Jassid has been found on paddy, sugarcane, jola, wheat, ragi and certain unidentified grasses, on bunds of paddy and sugarcane fields and in marshy areas near tanks, etc.; Nymphs and Adults feed on the sap of the plant and as a result faint whitish patches appear on the under-surface of the leaf. Oviposition serration causes injury to the sheath of the stem. In Laboratory trials, seedlings enclosed with White Jassids developed a smaller number of stunted tillers (4) with delayed earhead development as compared with the healthy control (15 well-grown tillers with earheads).

The dagger-like ovipositor makes a slit in leaf-sheath and the eggs are laid in it. On paddy the leaf-sheath on the stem is preferred to leaf for egg laying and on sugarcane the lamina is invariably preferred to the midribs. The longitudinal streak-like slit indicates the presence of the eggs in the midrib, leaf sheath and lamina. The portion of the lamina around the slit presents a bulged appearance.

* Division of Entomology, Department of Agriculture, Bangalore.

The life-cycle of the insect when bred on sugarcane, occupies 47 days (July, August) incubation period being 15 days. The newly emerged adult is pale white but soon the forewings develop a very faint greenish tinge.

The following characteristics have been observed in regard to the two varieties of Jassid.

Characteristics	Green	White
1. Size	Bigger	Smaller
2. Colour	Conspicuous greenness	Pale white colour with faint greenish tinge
3. Attraction to light	Not attracted	Attracted
4. Host plants ..	Sugarcane, Jola	Paddy, Sugarcane, Jola, Ragi, Wheat and certain unidentified grasses
5. Places where adults are seen after harvest of crop	..	On grasses in marshy areas

Further detailed observations on the two varieties of the Jassids will be published separately.

Pyrilloxenos sp.? *compactus* Pierce heavily parasitises the adults in certain seasons. Presence of the parasities is indicated by protuberances in the ventrolateral region of the abdomen. The stylopised adults continues to feed and to lay eggs. In most of the stylopised adults the abdomen turns a little greenish yellow. *Leptus* sp., a red erythraeid mite, attacks the adults and nymphs in nature. *Gonatocerus* sp. has been obtained from egg masses collected from the field.

Acknowledgements

My grateful thanks are due to Dr. M. Puttarudriah, Government Entomologist, Department of Agriculture, Bangalore, for his guidance and encouragement in this study, and to the Government Entomologist, Coimbatore, Madras, for supply of the identified specimens. My thanks are also due to the authorities of the Common Wealth Institute of Entomology, London, for the determination of the species.

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(Received: 5th February 1958)

SOME OBSERVATIONS ON THE BIOLOGY AND HABITS OF *HALTICA CYANEA* WEBER

By M. Appanna[1] and K. S. Siva Shankara Sastry[2]

Introduction

This bluish beetle is found in the marshy areas, always congregating in large numbers alongside the channels which run into paddy fields, which they invade and are seen resting on the blades. The cultivators get scared of this insect as a pest of paddy because of the large number and seek advice for its control. An intensive observation was made on the habit of this insect and incidentally its life-history was studied.

History (Host Records)

Lefroy (1909) and Ramakrishna Ayyar (1940) have recorded this insect on the weed—*Ammania* (Lythraceæ). Ayyar has further stated that this insect is not harmful to paddy but yet to be watched. Cotton (1936) records an allied species *Haltica jamaicensis* on *Jussiæa* sp. and unidentified garden beans. Mcann (1934) records the insect feeding freely on the water chestnut (*Trapa bispinosa*). The authors have noted its damage to *Jussiæa* sp. and an unidentified weed.

General Incidence

Though present throughout the year, it is found in large numbers during the months of June–November, after which it dwindles. In plots where paddy is not grown in summer the insect is rarely seen. The adult and the grub feed on the foliage of *Jussiæa* sp. The grubs skeletonise the leaves while the adults nibble and make dents. The adults also scrape the stem and the bulbous roots. Feeding is mostly during nights, though in the laboratory the grubs were seen feeding late in the evening. In cases of heavy feeding only midribs are left behind, and the entire lamina is eaten up except the regions where eggs are laid. The ' floats ' of the aquatic plant are readily fed upon by the adults and grubs.

Description

Adult.—The adult is a metallic hued bluish chrysomelid beetle (Fig. 1). The male is invariably smaller than the female and size appears to be the only external morphological character to distinguish the sexes. The copulation between sexes is not continuous but extends over a period of one week.

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Egg.—In the field, the eggs (Fig. 4) are usually laid on the lower surface of leaves, on stems and in the whorl of leaves, in groups of 3 to 21, being placed nearer to one another, but not in masses. In the laboratory the eggs were also laid on the glass of the containers on rare occasions. In only one instance a small number of eggs were laid on a paddy blade in the laboratory, but they did not hatch. The egg is brownish orange, elliptical and slightly elongated. On certain eggs, a black marking is observed (Fig. 1) which persists even if scratched. Perhaps this may be the stain of the fluid which exudes at the time of egg-laying which is generally observed near the eggs. But the grubs hatching out of the eggs with and without such marking were found to be similar. With the advance in age, the egg becomes dark brown, and hatching takes place in 48 hours. The newly hatched grub is greyish white as soon as it emerges out of the egg case and gradually turns black in about an hour.

Grub.—The grub (Fig. 2) is elongated, broad at the anterior end gradually tapering towards the posterior region, dark in hue, beset with a number of tubercles with fine bristles. It is active, moving quickly when disturbed. It commences to feed in about 2 hours after hatching. The grub undergoes usually two moults, the period of each of the developmental stages and the total life-cycle is shown in Table I.

Moult.—Moulting is by the dehiscence of the exoskeleton along median line of the body, the rupture extending from the anterior direction. The moulting is complete with the castskin being shed undisturbed. The newly moulted grub is orange coloured with a brownish head and gradually turns black in an hour's interval after moult.

Pupa.—Pupation is in the soil. The fully grown up grub burrows into (Fig. 3) the soil about $1\frac{1}{2}''$ to $2''$ deep and after preparing a chamber pupates in it after a prepupal period of 3–4 days. In the laboratory cultures the pupating grub burrowed up to $6''$ depth. The nature and structure of the soil might influence the depth to which the grub burrows. During the transformation the larva becomes more oblong, turns light brown in colour, which gradually deepens and the pupa becomes dark. The adult emerges inside the chamber and is light brown when newly emerged. It gradually develops the metallic colour and then comes out through the hole on the surface of the ground pushing itself up in the soil. The life-cycle from egg to adult was completed on an average in 23·7 days when the average minimum temperature was 74·1 and average maximum was 81·1.

Longevity.—The adult lives for a long time varying from 7 days to 33 days when fed. The females preponderate over males in laboratory cultures. The number of eggs laid by a female ranged from 12 to 55 (67 eggs were laid by a mating pair collected from the field).

TABLE I

Statement Showing the Period of Development of Haltica cyanea *Weber*

Sl. No.	Incubation Period	I Instar	II Instar	III Instar	Pre-pupal Period	Pupal Period	Total Life-Cycle	Sex
	days	days	days	days	days	days		
1	3	2	4	3	3	10	25	Female
2	3	2	3	4	4	10	26	,,
3	3	2	3	4	4	9	25	,,
4	3	3	2	4	4	9	25	,,
5	3	3	3	4	3	9	25	,,
6	3	3	3	4	3	10	26	Male
7	3	2	2	4	3	8	22	Female
8	3	2	3	4	4	7	23	,,
9	3	2	3	3	4	7	22	,,
10	3	2	3	3	4	6	21	Male
11	3	2	3	4	3	7	22	Female
12	3	2	3	4	3	7	22	Male
13	3	2	2	4	4	7	22	Female
14	3	2	3	3	4	6	21	,,
15	3	2	3	4	4	7	23	,,
16	3	2	2	4	4	7	22	,,
17	3	2	3	3	4	10	25	,,
18	3	3	2	4	4	10	26	,,
19	3	3	3	4	4	9	26	,,
20	3	3	3	4	4	9	26	,,

The insect is found in all its stages of development at one and the same time indicating that the breeding is continuous and generations overlap.

Host Preference Studies.—With a view to find whether the insect would infest the cultivated crops, some trials were conducted in the laboratory and observations were made in the field. Though the

adults were observed to rest on various crops like Paddy, Ragi, ornamental plants there was no evidence of feeding and much less breeding since the grubs were never seen on any of them. In the laboratory, a number of plants like Paddy, Ragi, Cotton, Tomato, Castor, Sweet Potato, *Portilaca oleraceæ*, *Euphorbia geniculata*, *Datura shemonius*, *Oxalis* sp. and Potato—were tested to ascertain the insect's alternate food plants if any. The adults and grubs were starved for 2 days and were later provided with the above-mentioned host plants. None of these plants were however fed upon by the insect. In trials where *Jussiæa repens* was provided along with otner plants, the adults and grubs fed only on this host. These few tests have indicated that its preferred host is *Jussiæa repens*.

ACKNOWLEDGEMENTS

The photos are by Sri. P. R. Raghuram, Senior Artist of the Department, and our thanks are due to him.

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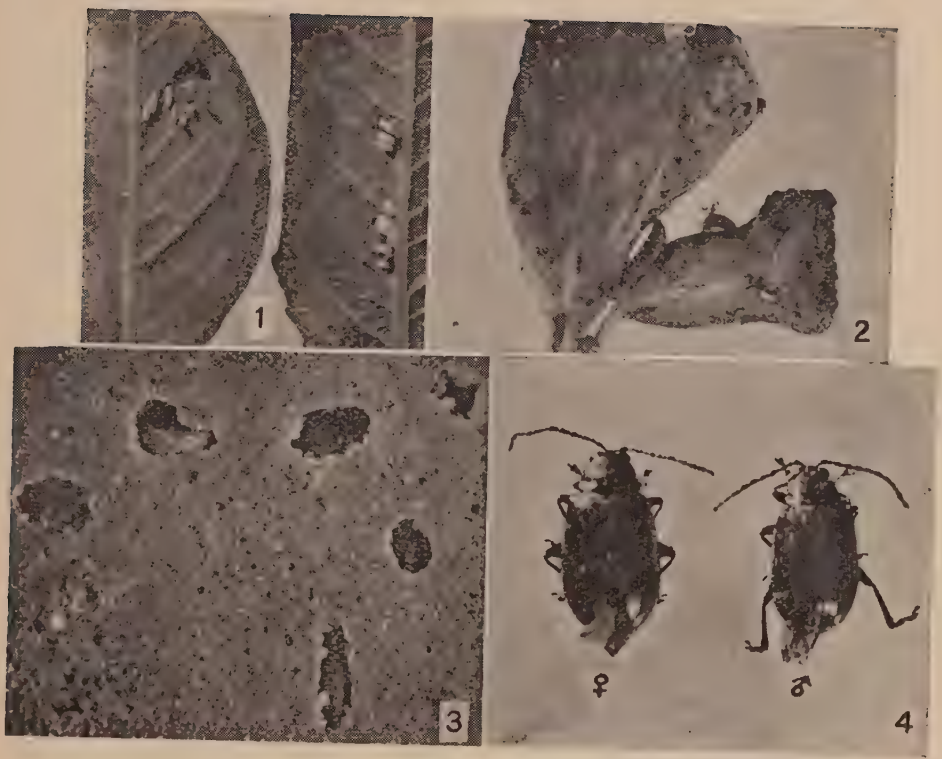
[*An allied species of Flea beetle*, Haltica ignea (*Blackb.*) *is said to occur occasionally in dense clusters on paddy plants in New South Wales. No economically significant loss due to them has been however reported so far.*—EDITORS.]

(Received: 5th February 1958)



FIGS. 1-4

SOME FINDINGS ON THE NUTRITION OF SUGARCANE CROP IN MALNAD TRACT OF DHARWAR DIVISION

By H. V. Hiregoudar*

Introduction

Sugarcane is an important commercial crop grown in the Malnad tract of Dharwar Division. The rainfall in this tract is very heavy varying from 40″ to 80″. The soils are mostly lateritic. The peculiar features of sugarcane crop grown in this tract is that except for 2–3 irrigations given to the crop in the beginning, it is almost rain-fed.

Amongst the major nutrient elements—Nitrogen, phosphorus and potash, the role of nitrogen in sugarcane cultivation needs no emphasis as it is most essential for plant growth. Next in importance comes phosphorus and potassium. Sugarcane crop is a heavy feeder and therefore ample supply of plant nutrients is necessary for its proper growth.

A number of investigations on the fertilisation of this crop have been conducted at the Agricultural Research Station, Alnawar, and some of the important findings are reported in this paper.

(1) Top Dressing with Phosphatic Fertilizer

An investigation was undertaken at the Agriculture Research Station, Alnawar, for three years to find out whether application of phosphates would be helpful in increasing the yield of sugarcane.

The variety used was Co. 419 and planting was done in the middle of February (*Eksali* planting). A basal dose of 10 cartloads of compost per acre were applied before planting. Three levels of nitrogen were employed, namely, 150, 225 and 300 lb. per acre along with 100 lb. P_2O_5 per acre and without P_2O_5. Nitrogen was supplied in the form of ammonium sulphate and groundnut cake in equal ratio in 3 doses. P_2O_5 was applied in the form of dicalcium phosphate in one dose only before planting by placing the fertilizer 3″ deep in furrows. The layout was randomised blocks with 4 replications. The crop was harvested in the last week of next February. The yield of cane obtained is furnished in Table I.

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TABLE I

Average Yield of Cane in Tons per Acre

	Treatment	1953—54	1954—55	1955—56	Average of 3 years
1	0 P_2O_5 + 150 lb. N ..	14·5	18·1	33·4	22·0
2	do. + 225 lb. N ..	14·6	22·0	33·7	23·4
3	do. + 300 lb. N ..	15·9	24·3	35·4	25·2
4	100 lb. P_2O_5 + 150 lb. N ..	22·5	32·6	40·3	31·8
5	do. + 225 lb. N ..	22·9	35·1	44·8	34·3
6	do. + 300 lb. N ..	25·1	38·2	46·9	36·7
	POOLED DATA				
	0 P_2O_5 ..	15·0	21·5	33·8	23·4
	100 lb. P_2O_5 ..	23·5	35·3	44·0	34·3
	C.D. for N. levels ..	3·7	4·0	3·9	..
	C.D. for P. levels ..	3·5	3·3	3·1	..

From the data given in Table I, it is seen that during all the three years, the treatment with 100 lb. P_2O_5 is significantly superior to the treatment without P_2O_5 and response to increase in levels of N is linear. During the year 1953–54, 1954–55 and 1955–56, top dressing of 100 lb. P_2O_5 has given 36·2%, 64·2% and 30·2% higher yields respectively over the treatments without P_2O_5. The average of 3 years shows that 100 lb. P_2O_2 gives 46·5% higher yield over no P_2O_5. 150 lb. N and 100 lb. P_2O_5 could be recommended from an economical point of view.

(2) EFFECT OF DIFFERENT RATIOS OF ORGANIC AND INORGANIC NITROGEN ON PLANT AND RATOON SUGARCANE CROP

A reference has already been made on the effect of nitrogen on sugarcane growth. It could however be supplied either in organic or inorganic form. A long range experiment has been in progress since 1950 to establish a suitable ratio of organic and inorganic forms of nitrogen in combination with and without a basal dose of farm-yard manure for sugarcane crop in Malnad tract and some of the results obtained are reported here. Variety under test was Co. 419. The nitrogen dosage was 150 lb. N per acre for all the treatments. The different treatments thus employed were:

(1) Oil cake alone with no farm-yard manure.

(2) Sulphate of ammonia and oilcake in 1 : 2 ratio with no farm-yard manure.

(3) Sulphate of ammonia and oilcake in 1 : 1 ratio with no farm-yard manure.

(4) Oilcake alone with 10 cartloads of farm-yard manure.

(5) Sulphate of ammonia and oilcake in 1 : 2 ratio with 10 cart-loads of farm-yard manure.

(6) Sulphate of ammonia and oilcake in 1 : 1 ratio with 10 cart-loads of farm-yard manure.

The above treatments were employed on both plant and ratoon cane. The lay out of the trial were randomised blocks with five replications. The yield data are given in Tables II and III.

TABLE II

Yield in Tons per Acre (Plant Cane)

	Treatments	1950—51	1951—52	1952—53	1953—54	1954—55	1955—56	Average 5 years
1	0 F.Y.M. + cake alone ..	30·9	21·1	23·9	17·5	26·6	..	24·0
2	0 S./A. and cake 1 : 2 ratio ..	26·7	21·8	22·1	14·2	27·6	..	22·5
3	0 S./A. and cake 1 : 1 ratio ..	27·7	26·1	21·6	14·6	25·5	..	23·1
4	10 C.L. F.Y.M. + cake alone ..	33·0	25·7	25·5	17·1	28·2	..	25·9
5	10 C.L. S./A. and cake 1 : 2 ratio	36·4	24·4	24·1	15·1	25·0	..	25·0
6	10 C.L. S./A. and cake 1 : 1 ratio	31·6	23·1	21·2	15·6	26·0	..	23·5
	POOLED DATA							
	Cake alone ..	32·0	23·4	24·7	17·3	27·4	..	25·0
	S./A. and cake 1 : 2 ..	31·6	23·1	23·1	14·6	26·3	..	23·8
	S./A. and cake 1 : 1 ..	29·6	24·6	21·4	15·1	25·8	..	24·0
	No F.Y.M. ..	28·4	23·0	22·5	15·4	26·6	..	23·2
	10 C. L. F.Y.M. ..	33·6	24·4	23·6	16·0	26·4	..	24·8

TABLE III

Yield Data of 5 Years of Ratio Experiment (Ratoon Crop)
Yield in Tons per Acre

0 F,Y.M. + cake alone ..	23·0	21·3	14·0	24·3	22·2	21·0
0 S./A. and cake 1 : 2 ratio ..	21·8	21·7	14·9	26·4	28·6	22·7
0 S./A. and cake 1 : 1 ratio ..	20·6	22·7	15·0	27·0	26·5	22·2
10 C.L. F.Y.M. + cake alone ..	21·6	23·2	16·7	22·6	26·6	22·1
do. + S. /A. and cake 1:2 ratio	22·4	21·4	14·1	25·9	26·8	22·1
do. S./A. and cake 1 : 1 ratio	21·5	24·0	14·1	25·2	26·2	22·0
POOLED DATA						
Cake alone ..	22·3	22·2	15·4	23·4	24·4	21·6
A S./A. and cake 1 : 2 ratio ..	22·2	21·6	14·5	26·2	27·7	22·4
S./A. and cake 1 : 1 ratio ..	21·0	23·4	14·6	26·1	26·4	22·1
No F.Y.M. ..	25·1	21·9	14·8	25·9	25·8	22·7
10 C.L. F.Y.M. ..	25·2	22·9	15·0	24·6	26·5	22·8

During all the five years none of the treatments both in case of plant cane as well as ratoon are significant over the others. The (cake

alone) treatment however has given higher yields over others. This might be due to small amount of phosphoric acid present in cake.

Another interesting observation is that there is no significant difference between no farm-yard manure, and 10 cartloads farm-yard manure per acre. The treatment with 10 cartloads farm-yard manure has given only 1·6 tons higher yields in case of plant cane and hardly 0·1 ton in case of ratoon over no F.Y.M. treatment.

ACKNOWLEDGEMENTS

My grateful thanks are due to Dr. H. R. Arakeri, formerly Sugarcane Specialist, Government of Bombay, for encouragement and guidance. My thanks are also due to Sri. D. V. Murthy, Assistant Editor, for having revised the manuscript and offering suggestions.

(Received: 5th February 1958)

IMPROVISED RAGI SEED-DRILL

By V. M. Mallaraj Urs*

Introduction

Ragi is one of the most important crops of Mysore State. It occupies an area of nearly two million acres in the State. It grows in tracts receiving a rainfall of 20″ to 30″. This crop is mostly raised as a rain-fed crop but to a limited extent under irrigation in tracts where irrigation facilities exist. Red and light red soils, loams and sandy loams are found to be highly suited for raising this crop.

Ragi under rain-fed condition is either raised by broadcasting the seeds or sown by means of a seed-drill or by transplanting seedlings. The seed-drills in usage vary with respect to the number of tynes and also the space between tynes, *viz.*, 3, 4, 6 and 12 with distances between them of 12″, 9″, 9″ and 4½″ respectively.

In view of the importance of Ragi crop which is raised both for food and fodder, the Research Sections of the Department of Agriculture have been engaged in bringing about increased yield per annum by effecting improvement in varieties as well as cultural practices. Besides evolving high yielding varieties, the Department after continued research have recommended that drill sowing is better than broadcasting and the question of improving the seed-drill has been engaging the attention of the Agricultural Engineering Section of the Department.

Description of the Indigenous Seed-Drill

Ragi seed-drill used for sowing consists of a head-piece, tynes, seed tubes, seed cup, beams and handle with grip (Fig. 1). Head piece is made of *Hunse*, *Honne*, or *Bilijaly* wood, rectangular in Section of 3″×4″ or 4″×6″ and varying in length from 3′ to 6′ according to the type. Holes are made through the head-piece at equal distance for fixing the tynes. Tynes made of hollow bamboo pieces of 1″ diameter, about 8″ to 12″ in length, are fitted into the holes in the head piece. These tynes are cut obliquely at the lower end (Fig. 2). The tyres serve the purpose of opening the furrows as well as a passage for the seeds to reach the soil. The oblique cut at the end prevents the earth from clogging the tyne and stopping the flow of seeds. The upper ends of the seed tubes are fixed in the holes made for the purpose in the seed cup. Thus seed tubes of different lengths, made of hollow

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bamboos, converge at the top and are connected with the seed cup. The seed cup is made of hard wood like rose or teak and shaped like a funnel. A number of holes are bored in the centre around the pyramid of the seed cup in a slanting manner and depending upon the number of seed tubes to be fixed. The cup is placed firmly over the seed tubes and the whole structure is tied up by means of cotton rope of $\frac{1}{4}''$ diameter. The head piece is provided with a pair of bamboo beams of 8′ length, for bullock draft, fixed in front of the head piece. A handle is provided at the central top of the head piece of size $1\frac{1}{2}'' \times 2'' \times 2\frac{1}{2}''$. The drill is provided with a line marker made of wood or iron at either end placed at half the distance between the tynes.

The bamboo tynes and tubes were subsequently replaced by metal ones to facilitate easy flow of seeds and durability.

Defects

The indigenous seed-drill has certain disadvantages. Some parts of the seed-drill are made of hard wood, and in some cases, the tubes and tynes are made of metal. This increases the weight of the seed-drill and as a result, the tynes work to a depth of $1''$ to $2\frac{1}{2}''$ while normally $1''$ to $1\frac{1}{2}''$ would be sufficient for proper seed germination.

The metal or bamboo tynes which are cut obliquely at the lower end are meant to prevent clogging of the soil, but in moist soils, the tynes will still be clogged—preventing the flow of seeds. Further as the cut is very sharp, it penetrates deeper into the soil making the furrows very narrow.

The seed-drill is not provided with any seed covering device. After sowing, the seeds have to be covered by working a brush-harrow which involves extra time, labour and cost.

Improvements Effected by the New Seed-Drill

To overcome the drawbacks mentioned above certain modifications have been devised.

The pattern of the modified seed-drill in general resembles the indigenous 6-tyned one with the following modifications (Fig. 3). The lower end of tne tyne is cut vertically for about $4''$ and is widened with a certain curvature (Fig. 4). Two wheels made of wood of size $5\frac{1}{2}''$ diameter and $1\frac{1}{2}''$ width, are provided at the ends of the head piece, connected by means of a U clamp, and placed at half the distance between the tynes. Cover plates made of steel are connected to the back of the head-piece behind each tyne. The plates are given certain curvature at the bottom and are fixed at an angle of 30° to 35° by means of wing bolts and nuts. The plates can be moved up and down to suit to the length of tynes (Fig. 5).

The vertical cut and the curvature given at the lower end of the tyne prevents deep penetration, makes wider furrows and helps in easy flow of seeds. The wheels provided at either end of the head-piece regulates the penetration of the tynes. Even if the implement is made of heavy material, the wheels can take the weight and also serve as markers. In addition they facilitate easy movement of the implement, thus reducing the draft of the implement to a certain extent. As the seed-drill moves forward, the cover plates follow the tynes, and cover the seeds in the furrows. This brings about packing of the soil which is necessary for proper seed germination. This device avoids unnecessary duplication of operations as practised now like the working of a separate brush-harrow, thus saving time, labour and cost.

Data collected on the working of the modified Ragi seed-drill as compared with the indigenous one is given below. The working of the new seed-drill was tried at the Agricultural Research Station, Hebbal.

TABLE

Particulars	Indigenous Seed-Drill	Modified Seed-Drill
1. Weight	26½ lb.	38¾ lb.
2. Cost of implement	Rs. 30	Rs. 47
3. Depth of penetration	Fluctuating from 1″ to 2½″	Uniform 1¼″.
4. Draft	56 lb.	45 to 50 lb.
5. (*a*) Labour required for sowing and covering one acre	1 to 2 pair bullocks and 5 to 6 men	1 to 3 pair bullocks, and 2 to 3 men
(*b*) Cost of working per acre	Rs. 1–14–0	Rs. 1–6–0

In the indigenous seed-drill the depth of penetration was found to fluctuate between 1″ to 2½″ whereas in the modified one the depth of penetration is uniform at 1¼″. This facilitates proper germination. The draft of the indigenous implement is 56 lb., whereas the modified one has a draft ranging from 45 to 50 lb., thus effecting a reduction of 6 to 11 lb. The labour required for sowing and working a brush-harrow over an area of one acre is 1/2 pair bullocks and 5/6 men as per the old method, whereas in the modified one 1/3 pair bullocks and 1/6 men

(it is assumed that one pair of bullocks and 2 men sow an area of 3 acres per day and one pair of bullocks and one man cover an area of 6 acres per day with the brush harrow). As the sowing and covering operations are done simultaneously, time required for working the brush-harrow separately is saved. The cost of the modified seed-drill works out to Rs. 47 and the indigenous one Rs. 30. The cost of working the modified one is Rs. 1–6–0 per acre, that of the the indigenous one is Rs. 1–14–0, thus there is a saving of As. 8 per acre in the working expenses. The extra cost of Rs. 17 paid towards the new seed-drill is easily recovered after working 34 acres of land, *i.e.*, after working the drill for 11 or 12 days. Although the weight of the new seed-drill has increased by 12¼ lb. it can be borne by the wheels provided, as evidenced in the reduction of draft of the seed-drill.

Conclusions

The defects in the existing Ragi drill and the improvements suggested to overcome the disadvantages are discussed. In the improved seed-drill, the modified tynes prevent deep penetration, makes wider furrows and helps in the easy flow of seeds.

The wheels provided regulate the penetration of the tynes, reduce the draft of the implement and serve as markers.

The cover plates help in packing of the soil, and doing away with the working of a brush-harrow separately, thus saving time, labour and cost.

Acknowledgements

I wish to thank Sri. R. S. Aiyangar, Assistant Professor of Agronomy, for his valuable suggestions. I also thank the members of staff of the Engineering Section of the Agricultural College, Hebbal, for their assistance. My thanks are also due to the Departmental Artist for the photographs.

I also wish to express my gratitude to Sri. M. Mallaraj Urs, Director of Agriculture, and Sri. B. Venkoba Rao, Principal of the College, for their keen interest and encouragement.

(Received: 24th March 1958)

FIG. 1. Indigenous Ragi Seed-drill.

FIG. 2. Bamboo and Iron Tynes (Old).

FIG. 3. Improvised Ragi Seed-drill.

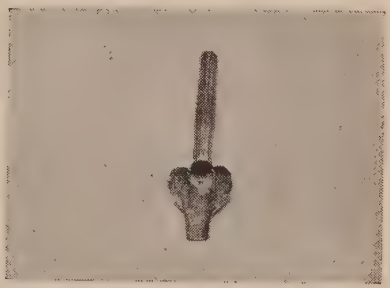

FIG. 4. Improvised Seed Tyne.

FIG. 5. Seed Covering Plate.

General, Review and Extension Articles

CONTROL OF FIG RUST CAUSED BY *CEROTELIUM FICI* (CAST.) ARTH.

N. S. VENKATAKRISHNIAH*

THE rust on fig *Ficus carica* L. caused by *Cerotelium fici* (Cast.) Arth. has become virulent in recent years on plants raised in orchards round about Bangalore. Infection is usually observed on the leaves and becomes virulent at about the time the fruits begin to develop. The infected leaves gradually turn brown, begin to dry up and are shed prematurely causing considerable damage to the crop. Young leaves that come up afresh are in turn infected. Infection is also observed in recent years on immature green fruits, fruit stalks and on all green portions of the stem. The sori appearing on these portions are numerous, small, brownish and similar to those on the leaves of the plant. Only the uredo stage is observed.

The continued loss of leaves and the spread of infection to fruits affects largely the production and development of fruits. Experiments for the control of the disease were conducted on plants during the years 1956–57 and 1957–58 round about Bangalore. 1% Bordeaux mixture, fine sulphur dust and two strengths (0·3% and 0·15%) of Ultrasulphur solution of Messrs. Geigy Insecticides (Private) Ltd., Bombay, were tried and their comparative effect was noted. Spraying done with Bordeaux mixture left stains on the fruits rendering them unsightly and reducing their value in the market. Dusting with fine sulphur gave indefinite results and in some cases caused bronzing of the fruits. Spraying trials conducted with Ultrasulphur solution at the rate of 1 lb. in 30 gallons of water gave very satisfactory control of the disease. The first spraying was given when the fruits were still young of about the size of a marble and repeated thrice at intervals of 25 to 30 days. Spraying done on the developed fruits did not injure them in any way.

Ultrasulphur is first dissolved completely in a little quantity of water in a small vessel to make into a thin paste and the resulting dirty milky solution is poured into the remaining quantity of water in a big

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container to make up the required strength, stirred well and sprayed uniformly so as to cover thoroughly the under-surface of all the leaves on the plant. The sprayer and the containers should be washed well immediately after use. The strength of the solution may be reduced to 1 lb. in 60 gallons of water if the treatment is taken up early when the leaves are young and at the initial stage of infection.

(Received: 16th April 1958)

PREPARING A VILLAGE CROP PRODUCTION PLAN

By Dr. H. R. Arakeri*

In these days of complex economy nothing concrete can be achieved without proper planning. It is for this reason that the National Development Plans have been prepared and will be prepared in future too. During the Second Five-Year Plan, stress is being laid on the preparation of Development Plan for each village as a unit. Village Development Plan naturally includes all items such as cultural, social, public-health, etc., although Agriculture forms a pivot on the development of which progress under other headings is supposed to be dependent. For the preparation of Village Development Plans, it is necessary to lay down lines on which such plans could be prepared. In this note an attempt is made to give an outline for the preparation of Village Development Plans so far as crop production is concerned. A set of proformas for the purpose is also given.

Preparation of Village Development Plan involves considerable work with regard to collection of basic data and in assessing the present resources and future requirements correctly. This work can be entrusted to a Village Development Committee having a trained Agricultural Graduate as its Secretary. The Secretary should have complete knowledge of Village conditions, existing Agricultural practices and the recommendations made by the Department for that area. The preparation of Development Plan includes the following steps.

(1) Survey of the Existing Conditions and Crop Production Practices

It is absolutely necessary to collect this basic information. This should be collected as accurately as possible by personally verifying the conditions on the spot.

(2) Defects in the Existing Practices

This requires careful consideration of each existing practice as to whether there is any defect in it. The question of deciding as to whether there is any defect in the existing practice should be discussed thoroughly in a meeting of the Development Committee after taking all aspects into consideration. If there is no sufficient proof to show that there is any defect in existing practice, further trials on cultivators'

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fields based on the results obtained in the departmental experimental stations should be arranged, to decide about the feasibility of continuing the existing practice or otherwise. Till then the practice may be listed as defective but large-scale adoption need not be taken up.

(3) Listing the Recommended Practices against the Defective Existing Practices

The role of the Agricultural Technician is very important and decisive in this connection. He should very carefully list all the departmental recommendations after explaining and convincing the members of the Development Committee about the utility and advantages of each recommendation over the existing practice. If there are no definite recommendations on any particular problem the question should be referred to the District Level Officers for passing on the same to the State Level Technical Officers concerned and the directives in that connection obtained.

The information required under paras 1, 2 and 3 should be collected in Proforma No. 1.

(4) Chalking out the Programme of Development for the Year

Under this heading all the items of development work to be taken up in different areas should be listed down. It should be also indicated as to the extent of area to be covered under each item in a particular year. It would be also necessary to list down the demonstrations that are to be conducted on cultivators' fields to convince them about the utility and advantages of improved practices over the practices in vogue.

This information can be conveniently tabulated in Proforma No. 2.

(5) Working out the Requirements

After knowing the programme of development work for the year, it is necessary to work out the requirements of the village to fulfil the programme laid down. It would be necessary to assess the available resources in the village as regards supply of manure, seeds, implements, labour, finance, etc. After doing so, it would be possible to work out the exact requirements under each of these headings that would have to be procured from outside. Proforma No. 3 can be utilised for this purpose.

(6) Working out the Total Agricultural Production

It is possible, after knowing the resources and the possibilities of getting the requirements from outside, to work out the total agricultural production that could be achieved in different years as far as

that village is concerned. In this connection it would be necessary to work out the present level of production and the level of production to be achieved and thus know the extra production that could be achieved. This can be tabulated in Proforma No. 4.

PROFORMA No. 1

(A) General and Crop Production Data

(1) Name of the village.

(2) Geographical features about the situation of the village, etc.

(3) Soils and climatic conditions.

(4) Population according to age group, and school-going children.

(5) Livestock population according to kinds of livestock.

(6) Area—total irrigable and area under different crops, cultivable waste and uncultivable waste, etc.

(7) Scope for tree planting.

(8) Credit facilities and marketing facilities.

(9) Any other items.

(B) Crop Production

	Existing practices	Defects in the existing practices	Recommendation of the Department
I. Soil Management			
(1) *Land Improvement:*			
(*a*) Bunding.			
(*b*) Levelling.			
(*c*) Acid soil improvement.			
(*d*) Alkali soil improvement.			
(*e*) Drainage.			
(2) *Tillage Practices :*			
(*a*) Ploughing.			
(*b*) Seed-bed Preparation.			
(*c*) Sowing and planting.			
(*d*) After cultivation.			
(3) *Manures and Fertilisers:*			
(*a*) City compost using night soil.			
(*b*) Village compost using night soil.			
(*c*) Farm compost.			

	Existing practices	Defects in the existing practices	Recommendation of the Department
(*d*) Farm-yard manure—preservation.			
(*e*) Green manuring.			
(*f*) Method of determining fertiliser requirements.			
(*g*) Choice of fertilisers.			
(*h*) Method and time of application of fertiliser.			
(*i*) Dosage of fertilisers per acre.			
(*j*) Care in applying fertilisers.			
(4) *Crop Rotation and Mixed Cropping :*			
(*a*) Rotations.			
(*b*) Mixtures.			
(*c*) Fallowing.			
(5) *Dry Farming and Irrigation :*			
(*a*) Dry farming methods.			
(*b*) Irrigation facilities.			
(*c*) Methods of layout for applying irrigation water.			
(*d*) Interval between two irrigations.			
(*e*) Dosage of irrigation water.			
(6) *Soil Erosion Control :*			
(*a*) Extent of soil erosion.			
(*b*) Steps taken to control soil erosion.			
Afforestation.			
Bunding.			
Contour trenching.			
Strip cropping.			
Contour farming.			
Silt trapping.			
(7) *Weed Control :*			
(*a*) Problematic perennial weeds and steps to eradicate them.			
(*b*) Problematic annual weeds and steps to eradicate them.			
II. Implements			
(*a*) Ploughs.			
(*b*) Clod crushers.			
(*c*) Levellers.			
(*d*) Harrows.			

	Existing practices	Defects in the existing practices	Recommendation of the Department
(*e*) Threshers.			
(*f*) Cultivators.			
(*g*) Harvesters.			
(*h*) Winnowing implements.			
(*i*) Water lifts.			
(*j*) Seed treating appliances.			
(*k*) Appliances for preparing produce for market.			
(*l*) Chaff cutters.			
(*m*) Spraying and dusting appliances.			
III. Crop Production Practices (*For each crop separately*)			
(*a*) Distribution at present and possibilities of extension.			
(*b*) Soils on which the crop is raised.			
(*c*) Preparatory tillage.			
(*d*) Seed-bed preparation.			
(*e*) Sowing or planting.			
(*f*) Seed selection.			
(*g*) Seed rate.			
(*h*) Raising of seedlings.			
(*i*) Care of seedlings.			
(*j*) Time of planting or sowing.			
(*k*) Inter-cultivation.			
(*l*) Manuring.			
(*m*) Top-dressing.			
(*n*) Harvesting.			
(*o*) Threshing.			
(*p*) Winnowing.			
(*q*) Preparation for market.			
(*r*) Preparation for storing.			
(*s*) Pests.			
(1)			
(2)			
(3) etc.			
(*t*) Diseases.			
(1)			
(2)			
(3) etc.			

PROFORMA No. 2

Improved Practices to be Adopted and Requirements to Adopt these Practices

Sl. No.	Items of improved practices to be adopted in the village (1) Bunding (2) Alternate implements (3) Etc.	Area on which this method could be adopted on large-scale Acres	Requirements					
			(1) Extra labour	(2) Finance	(3) Imple-ments	(4) Ferti-lisers	(5) Chemi-cals	(6) Etc.
1	2	3	4	5	6	7	8	9

PROFORMA No. 3

Summary of Requirements and How to Meet These Requirements

Particulars	Total requirements for the year	To be obtained from	
		(1) Local resources	(3) From outside
1 Finance ..			
2 Labour ..			
3 Seeds ..			
4 Implements ..			
5 Nitrogenous fertilisers ..			
6 Phosphatic ,, ..			
7 Potassic ,, ..			
8 Insecticides ..			
9 Fungicides ..			
10 Etc. ..			

PROFORMA No. 4

Potentialities of Crop Production

Sl. No.	Particulars	Existing production level			Expected production							Extra production (Difference bet ween columns 12 & 3)
		(1) Total Units (acres)	(2) Production per unit (acre)	(3) Total production	(1) Extent of area to be covered by improved practices (acre)	(2) Production per unit (acre)	(3) Total production	(4) Area continuing with existing practice (acre)	(5) Production per acre	(6) Total production	(7) Total production for the year (Total of col. Nos. 8 & 11)	
1	2	3	4	5	6	7	8	9	10	11	12	13
1	Paddy ..											
2	Jola ..											
3	Wheat ..											
4	Gram ..											
5	Cotton ..											
6	Vegetable											
7	Pulses ..											
8	Etc. ..											

SOME NUTRITIONAL DISORDERS IN CITRUS

By N. N. Dikshit*

Introduction

During recent years, citrus cultivation has received increasing attention, both because of people's enthusiasm to grow more fruit as well as due to the fact that it pays to do so. But the efforts have been thwarted to some extent due to the occurrence of several diseases. This article is intended to draw the attention of growers to those maladies of citrus which arise out of nutritional disorders and are generally known as deficiency diseases.

It is well known that most of the fruit plants depend for their requirement of water and mineral nutrients on soil; and in producing the yield year after year from the same location they take up certain substances from the soil. If the fruit culture is to be maintained at an economic level and the fruit yield sustained at a desirable optimum it is necessary to restore the nutrients to the soil regularly. This precisely is what is done when we manure our crops. The usual fertilisation schedule consists of adding nitrogen, phosphorus and potassium to the soil in suitable form. While a general manurial programme is adequate for a number of fruit trees the citrus plant is little fastidious in its requirements and readily shows deficiency symptoms if one or more of the required elements are missing from the programme.

Deficiency Diseases Due to Major Elements

Our knowledge of identifying and remedying the deficiencies of most of the major and minor elements in citrus is fairly adequate, and the symptoms have been described in detail. But the diagnosis of these deficiencies should be done in consultation with the specialists who have the first-hand knowledge of identifying them in the field, to avoid needless confusion.

The role of some of the elements in plant growth and their requirement by citrus is given below:

1. *Nitrogen.*—This is the most widely used element as fertiliser and is required by the plants to put up vegetative growth and produce fruits. It is also most easily depleted from the soil and needs to be added regularly. If this element is excluded from the fertilisers the

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results are equally disastrous to the plant and the planter. In our country it can be applied to the plants in the form of ammonium sulphate or urea. It is better to apply a fraction of the total requirement in form of compost or oilseed cakes.

Starvation of nitrogen causes general yellowing of leaves, lack of vigour and erratic fruiting by the plant. Under the conditions prevailing in our country the requirement of a bearing citrus plant is about 1 to 2 lb. of nitrogen, *i.e.*, 5 to 10 lb. of ammonium sulphate. This quantity should be applied to the plant in two doses—about 5 pounds during April-May, to be followed up by another 5 pounds during September-October. In the areas which have good irrigation facilities the total requirements may be applied in three instalments, *i.e.*, first during January-February, second during May-June and the third during September-October. The principle behind applying the fertilisers in several doses is to provide the element to the plant at the most appropriate time. In addition, it also saves the loss of fertiliser from the soil.

Apart from the general yellowing the other characteristic feature of the nitrogen deficiency is that the midrib of the leaves turns yellow even when the rest of the leaves may not be fully chlorotic.

2. *Phosphorus.*—It plays an important role as it gets linked up in organic combinations in highly oxidised form. In the growing parts it is concentrated in the meristematic tissue which is the seat of activity during cell division. It also appears to help in the utilisation of nitrogen absorbed by the plant. Unlike the deficiency of nitrogen which can be recognised readily, phosphorus deficiency is a little elusive to detect. Even by leaf analysis methods the amount of phosphorus in the leaves of healthy plants vary from 0·1 to 0·6 % on oven-dry basis. A figure as low as 0·08% is considered as lower limit by some of the research workers, showing adequate phosphorus for citrus growth.

Phosphorus is applied in the form of rock phosphate, superphosphate, bone-meal and fish meal, etc., at the rate of $\frac{3}{4}$ to 1 lb. per plant. Before taking up the application it is better to get the soil analysed and decide the frequency of application and dosages in consultation with specialists.

3. *Potassium.*—It occurs in plant tissue as soluble inorganic salts and at times as salt of organic acids. The role of potassium in plant metabolism is considered to be of a regulatory or catalytic nature. It is found concentrated in young and actively growing regions of the plants such as buds, young leaves and root tips. In citrus trees it affects fruit size and juice quality. It apparently has little effect on vegetative growth and yield. It is applied in the form of potassium

sulphate or muriate of potash at the rate ¼ to ½ lb. per tree per year. Although most of our soils are not deficient in potash but still it is advisable to include some potash in regular fertilisation programme.

4. *Calcium.*—It is considered to be an essential element for healthy growth of the plants. Its effect on citrus roots is very pronounced and in its absence the root function and root growth usually collapse. Calcium pectate is supposed to hold the plant cells together and thus play a commenting role. It is also thought to neutralise certain acids which accumulate in the cells as products of metabolic activities of the plant. It is useful to note that calcium is more abundant in the citrus plant than any other mineral element. Application of calcium as carbonate or hydrated lime helps to correct the pH of acid soils. Liming of the orchards should be undertaken if the soil reaction is on the acidic side (about pH 5 and less).

5. *Magnesium.*—The green colouring matter of the plants contains magnesium as its component and some workers also consider it to be an enzyme activator. When it is deficient in the soils the leaves show general yellowing, yellow patches on the leaves along both the sides of the midrib in interveinal area. The most characteristic feature is a triangular green pattern along the midrib of the leaf towards the stalk.

In citrus, deficiency of magnesium is associated with severe chlorosis, premature defoliation, die-back of branches, poor root growth, alternate bearing, reduced yields and poor quality of fruit. It is however not necessary to apply magnesium if its deficiency is not established as a result of chemical analysis of the leaves. When the deficiency is established magnesium may be applied as dolomite or magnesium sulphate to the soil.

Deficiency Diseases Due to Trace Elements

The five elements whose role is given above are required by the plants in comparatively larger quantities and are known as major elements are macro-elements. There are other elements required by the plant in small quantities but if they are not supplied to the plant they tend to cause metabolic disorders in the plant and its growth and fruiting is adversely affected. In view of their requirement in such small quantities they are termed as minor or micro-elements. Their importance to the plant is much more significant although the quantities in which they are needed by the plant are small.

Some of the important micro-elements and their role in plant growth is given below:

1. *Zinc.*—It is required by the plants in very small quantities to enable them to carry on normal metabolism. If present in large quantities it has adverse effects on plant growth. The citrus plants show well-defined symptoms as a result of zinc deficiency. The normal green colour of the leaves changes to yellowish green between the lateral veins, but along the midrib the colour remains normal green. The leaves are narrower, reduced in size and their growth is bunchy. In advanced cases the small branches and shoots die out prematurely. The yield is reduced and the fruits become smaller, with thicker skin and poor quality. The deficiency can be readily corrected by spraying the affected plants with a solution of zinc sulphate; *i.e.*, 5 lb. of zinc sulphate and 2·5 lb. of hydrated lime in 100 gallons of water. Sometimes the above concentration will prove a little toxic especially when young plants are sprayed. In such cases the quantity of zinc sulphate and lime should be reduced to half of the recommended concentration. The trees should be sprayed when they have produced new growth.

2. *Copper.*—Like zinc, copper is also required by the plants in very small quantities and higher concentrations prove highly toxic. It is now fairly well recognised that copper takes part in the function of oxidising-reducing enzymes in the plants. When copper is deficient the succulent branches show gum pockets near leaf nodes, exudation of gumlike substance through the bark tissue and the 's' shaped appearance of the newly formed shoots. The deficiency can be corrected by spraying the affected plants with bordeaux mixture 1 : 1 : 100 (one pound of copper sulphate plus one pound of lime in 100 gallons of water).

3. *Manganese.*—The deficiency of manganese occurs with that of zinc in some cases, and it can only be cured by a combined spray of manganese and zinc sulphates. When there is deficiency of manganese alone, the young leaves show dark green veins with light green background of the leaf lamina. It is required by the plant in very small quantities and is clearly toxic in higher concentrations. It is found accumulated in physiologically active parts of the plant such as leaves. Probably it also plays a direct role in oxidation reduction phenomena specially in relation to iron compounds. Its deficiency can be corrected by soil application or by sprays containing half the quantity of hydrated lime.

4. *Iron.*—Iron is abundantly present in our soils but sometimes it is not readily available and the plants therefore cannot take it up and show the symptoms of iron deficiency. The leaves become yellow and on such leaves the veins remain green until the final stage of general chlorosis. The deficiency of iron is most difficult to cure and many

a time sprays as well as soil applications prove futile. Complex organic compounds also known as chelates are some times very effective.

General Remarks

Having described some of the deficiencies of major and minor elements required by the plant, it is very necessary to caution the readers from indulging in amateur diagnosis of deficiency symptoms. Most of them are caused by a number of complex factors and not due to straight deficiency of a particular element, and therefore it is not very prudent to attempt a diagnosis. In case of deficiency of trace elements spectrographic analysis or tissue test of foliage may be necessary.

If proper steps are taken at the time of planting the orchard, the chances of the appearance of the deficiency diseases are reduced to a good deal. It is also important to realise that the deficiency diseases come into the picture only when even in spite of measures for insect control as well as control of fungus diseases the symptoms do occur.

The plants should be obtained from a reliable source or a nursery certified by the Department. They should be planted in pits of correct size ($2\frac{1}{2} \times 2\frac{1}{2} \times 2\frac{1}{2}$ feet). It is desirable to mix one or two baskets of compost manure in the soil before filling the pits, and subsequently the plants should be manured regularly.

If the plants are showing one or more symptoms given in the preceding lines the best course is to contact the Officers of the Department of Agriculture and seek their advice.

(Received: 2nd April 1958)

COW DUNG GAS AND MANURE PLANT FOR VILLAGES

(Note by the Head of the Division of Chemistry, Indian Agricultural Research Institute, New Delhi)

Introduction

Over 50 per cent. of cow dung available with farmers in our country is burned as fuel for cooking purposes. It is recognized that this waste of a large proportion of a valuable manure is not desirable but in the absence of a practical solution of the problem of fuel in villages it has not been possible to divert the material for use as manure. In fact, it is interesting to note from a statement of Dr. H. J. Bhabha, Secretary to the Government of India, Department of Atomic Energy, that about 75 per cent. of the total energy requirement of India comes from the burning of cattle dung.[1] The problem has become of added importance now, in the context of the Second Five-Year Plan to increase crop production in the country and to exploit our indigenous sources of manures as fully as possible for this purpose.

The Indian Agricultural Research Institute took up this practical problem for investigation about 17 years back, to work out a system by which these two conflicting aspects—of burning dung for fuel purposes and using it for manuring of crops—could be reconciled. The experiments were concluded in 1954, with the design of a cheap and simply operated plant by which dung is in the first instance fermented so as to yield sufficient quantity of combustible gas which can be used for cooking purposes by the farmer and the residue that remains is still available for use as manure, without any loss of the manurial constituents. The village model of the gas plant, specially designed to suit conditions in rural areas, has since been installed in the houses of farmers in 12 villages around Delhi, to test their performance in actual practice. These plants have all been working successfully, without any breakdown for over 2 years, providing a continuous source of a neat and efficient fuel with which farmers have been doing their cooking, while the residue is being utilized for increasing crop productivity of their lands. The gas plant was successfully exhibited recently during the Annual Convention of the Farmers' Forum, in which visiting farmers from different parts of the country were shown the potentialities of this dual purpose innovation, which provides a practical solution for

[1] Proceedings of the Geneva Conference on Peaceful uses of Atomic Energy, **1**, p. 103.

their problem of fuel and restoration of dung for manurial use, simultaneously. The stage has now been reached at which its wide-spread adoption by farmers all over the country can be recommended.

The cost on the installation of the village model of the gas plant, sufficient for a family of 5 members, comes to about Rs. 350·00. No other expenditure on its day-to-day maintenance is required. The daily production of about 100 c.ft. of gas is obtained by regular addition of dung of 4 animals. The gas can be used for cooking as well as lighting purposes. The blue flame of the gas is hot and smokeless which makes cooking much more neat and quick.

No loss of the manurial constituents present in dung takes place in this process. The removal of only the heat constituents in the form of gas, makes the residue, actually a richer manure than the original dung. This has been proved by practical tests on crop growth conducted in this Institute.

No fly breeding takes place either in the fresh dung slurry in the digestion tank or in the digested slurry in the drying bed. It has been observed that fly maggots placed in the slurry in the drying bed do not survive.

The adoption of the gas plant offers a vast scope to farmers all over the country for increasing soil fertility and crop yields from their lands, with the added solution of the difficult problem of fuel in villages.

Working Principle of the Cow-Dung Gas Plant

The gas plant operates on the simple principle that when dung or any such organic matter ferments in absence of air, a combustible gas called methane is produced. In the village model of the gas plant, the fermentation tank is a brick-lined well, 12 feet deep and 6 feet in diameter which is filled with cow-dung, made into a liquid slurry with water. This is then covered with an iron drum 5 feet in diameter and 4 feet in height, introduced upside down into the well, which serves to cut off air and provide the necessary conditions for fermentation. The gas produced bubbles into the inverted drum which then begins to float and rise. Through an opening on the top of the drum the gas can be led to the kitchen by pipes and burned.

Maintenance of gas production is achieved by feeding about 100 pounds of dung daily through a funnel pipe which carries the fresh slurry to the bottom inside the well. The spent slurry overflows from the top of the well and collects in a pit from where it is periodically removed for use as manure.

Installation of the Gas Plant

This line drawing explains the details of construction of the village model of the gas plant designed at the I.A.R.I. To start with, a circular pit 7 feet in diameter is dug to a depth of 4 feet and then leaving a ledge R, 9 inches all round the pit, it is continued with a diameter of 5·5 feet to a further depth of 8 feet. The bottom of the well is then brick-floored or cement plastered. The walls of the well are brick-lined to a height of 6 feet from the bottom. At this point in the well, a sloping channel 8 inches wide and coming up to the top at a distance of 3 feet from the well, is dug on one side. The feeding pipe E is fixed in position in this channel and buried, with one end just emerging into the well and the other about 1·5 ft. above ground level. Brick-lining of the well is then continued and the brick wall is finally raised to 6 inches above ground level, leaving a drain F at the top for carrying the digested slurry to the drying bed H or the pit W.

Where the feeding pipe emerges out of the ground a square brick tank 2′×2′×2′ is constructed with the end of the feeding pipe emerging inside the tank. The tank is filled with sufficient earth and then floored with bricks which is finally cement plastered, flush with the bottom side of the opening of the pipe. This construction serves as a funnel for daily feeding of dung slurry which flows through the pipe and enters inside the well.

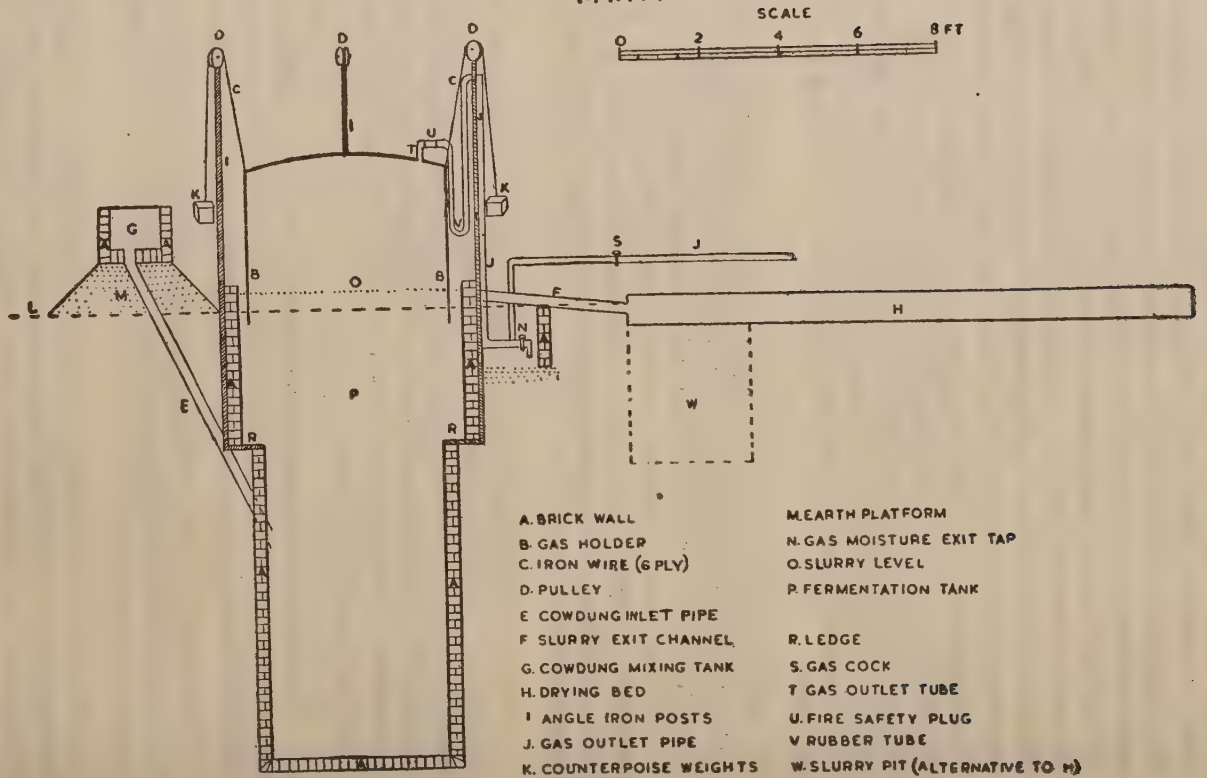
N is a small pit just outside the well, of inner dimensions 9 inches square and 12 inches depth, which serves as a water catch for removing condensed moisture from the gas pipe J. By opening this tap periodically, the condensed water is let out and the pipe line beyond is kept clear. The gas outlet pipe J with a wheel cock S is then connected as shown in the diagram.

The drum is then carefully introduced in the well which has been filled initially to the top with dung slurry. It sinks upto the ledge R on which it rests, the trapped air escaping through the nipple.

The angle irons or alternately wooden *ballies*, with pulleys on the top are then fixed at equidistant points outside the well wall emerging 6 feet above ground level.

The 3 wooden boxes K are tied to 12 feet lengths of twisted wire which pass over the pulleys and are tied to the handles of the drum. 8 bricks are then loaded in each box to counterpoise the weight of the drum. The nipple on the drum is then connected by a 6 feet hose pipe to the bend on the top of the gas pipe J which is tied to the angle irons or *ballies*.

MODEL OF COWDUNG GAS PLANT
I.A.R.I.



Operation and Maintenance

The gas plant is now installed for use. Production of gas normally starts within a fortnight. The gas cock is closed and the gas accumulating inside the drum causes it to float and rise up, with the supporting force of the wooden boxes. When the gas is required for use, the bricks from boxes are removed and the gas is forced into the outlet pipe by the pressure of the drum. The gas cock is opened and the gas burned in the kitchen through a suitable burner. After the gas has first formed, production is maintained by daily feeding about 100 pounds of dung as slurry, through the funnel. This produces about 100 c.ft. of gas sufficient for the cooking requirements of a family of 5 members.

The digested slurry which coverflows daily from the top into the drying bed H is thick and dries quickly in the dry season. It yields excellent manure containing 2 per cent. nitrogen and is superior to farm-yard manure. During the rainy season or even otherwise, the slurry can be removed and added to compost pits, to mix with straw and available refuse and yield a good bulky organic manure.

Materials required for installation		Approximate cost Rs.
1. Drum 5 ft. in diameter, 4 ft. in height made of 16 G.M.S., open at one end with 3 handles fixed at equal distance near the closed end of the drum and an iron rod ½″ in diameter welded all round the open end. One hole ½″ in diameter is bored on the top of the drum about 9″ from the edge and a nipple ½″ in diameter and 4″ long is welded in this hole		150·00
2. Angle iron 1½″ wide on each side, 12 ft. long, bent at right angles at a place 15″ from one end with shafts screwed on two sides	3	50·00
(*Alternative*:—Wooden *ballies* about 4″ in diameter and 10 ft. long with a 2″ broad and 10″ long slit sawed out in the centre at one end Rs.	3	20·00)

	Materials required for installation		Approximate cost Rs.
3.	Hose pipe $\frac{3}{4}''$ in diameter	8 ft.	6·00
4.	Iron pulleys 7″ in diameter	3	4·00
5.	G.I. twisted 6 ply wire $\frac{3}{8}''$ in diameter ..	45 ft.	5·00
6.	Wooden boxes 15″×10″×12″	3	5·00
7.	Feeding pipe 10′ long and 4″ square of 22 G.I. sheet		10·00
8.	G.I. pipe $\frac{1}{2}''$ in diameter	30 ft.	20·00
9.	G.I. pipe $\frac{1}{4}''$ in diameter	1 ft.	1·00
10.	G.I. elbow $\frac{1}{2}''$	4 pieces	2·00
11.	G.I. socket $\frac{1}{2}''$	4 ,,	2·00
12.	G.I. socket $\frac{1}{2}''$ reduced to $\frac{1}{4}''$	1	1·00
13.	G.I. Tee $\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}$	1	1·00
14.	Bolts and nuts $\frac{1}{2}''$ in diameter and 6″ long for pulleys	3	2·00
15.	Wheel cock $\frac{1}{2}''$	1	3·00
16.	Water tap for $\frac{1}{2}''$ pipe	1	2·00
17.	Rubber tube $\frac{3}{8}''$ in diameter	8 ft.	2·00
18.	G.I. bend $\frac{1}{2}''$	1	1·00
19.	Iron sheet 2 ft. square	1	1·00
20.	Burner	1	5·00
	For the Fermentation Well		
21.	Bricks (second quality)	1,600	35·00
22.	Cement	1 cwt.	7·00
23.	Sand (10 c.ft.) and *Rori* (broken stones) ..	5 c.ft.	5·00
			320·00
	Labour charges		30·00
	TOTAL ..		350·00

Abstracts

ENTOMOLOGY

1. Venkiteshwaran, S. P. (1957), " Effects of Meteorological factors on the dispersal of insecticide or fungicide," *Ind. J. Meteorology and Geophysics*, **8**, Special Number, 88–99.

The author has discussed as to how various types of insecticides are affected by different meteorological factors like turbulence, wind speed and direction, humidity, etc., on open land free from vegetation. It appears that for the most effective and economical use of the insecticides, spraying or dusting should be carried out either in the late afternoon or early night. They can also economically be applied in the very early hours of the morning. With the advance of the day, winds will become strong, the turbulence will be large, and insecticidal dusts will be shaken off the plants to fall on the ground or will be carried away by the wind.

(D. V. M.)

2. Cass, L. M. (1957), " A Dispersal of larvæ of the Colorado Potato Beetle, *Leptinotarsa decemlineata* (say) (Coleoptera: Chrysomelidæ)," *Can. Ent.*, **89** (12), 581–82.

When food becomes scarce grubs of the Colorado Potato Beetle, *Leptinotarsa decemlineata*, are known to travel considerable distances depending upon their stage of development in search of food.

(D. V. M.)

3. Mckinlay, K. S. and Geering, Q. A. (1957), " Studies of crop losses following insect attack on Cotton in East Africa. I. Experiments in Uganda and Tanganyika (illustrated)," *Bull. ent. Res.*, **48**, (4), 833–49.

The real losses occurring as a result of infestation by crop insect pests is still practically an unexplored field of study. The authors have investigated this problem with particular reference to some of the Cotton insect pests. It has been pointed out that the Cotton Plant, owing to its method of growth and crop formation, has remarkable powers of recovery from insect damage. It is only when damage exceeds the point at which recovery is still possible that insecticidal treatments will increase yields. Any factors tending to reduce the length of the growing season, or any increase in the severity of the insect attack, will reduce the plant's powers of recovery and make more likely the need for insecticidal control. Few will disagree with the

authors' statement that the presence of insects feeding on the plant does not always mean that insecticidal control would be necessary or profitable.

(D. V. M.)

4. Murthy, D. V. and Khan, M. Q. (1958), " Chemical Control of the Rice Stem-borer (*Schœnobius incertulas* Wlk.)," *Curr. Sci.*, **27**, (3), 89–90.

The authors have briefly reviewed the present position as regards the control of *Schœnobius incertulas*—a serious pest of paddy in the country by insecticidal methods. Some suggestions have also been made as to the lines for further study on this problem.

(D. V. M.)

5. Jagtap, Ahilya, P. (1958), " Studies on the entomogenous fungus, *Metarrhizium anisopliæ* (Metsch) Sorok," *Curr. Sci.*, **27**, (3), 99–100.

The muscardine green fungus *Metarrhizium anisopliæ* has been reported as occurring on *Pyrilla* sp. on Sugarcane in Bombay State previously. The author undertook investigations on the artificial culture of the fungus in the laboratory and has reported excellent growth of culture in a number of medias. Artificial inoculation experiments reveal that the fungus could parasitise *Pyrilla* sp. either during the nymphal or adult stages. Eggs are not affected.

(D. V. M.)

6. Subramanian, T. R. (1958), " A note on the insecticidal property of tea fluff," *Madras Agric. J.*, **45**, (3), 122–23.

Tea fluff which is obtained as a residual product in the manufacture of tea and found not useful for any purpose is found to be highly effective against a number of species of aphids when sprayed at the rate of 1 lb. of material in a gallon of water (and soaked overnight).

(D. V. M.)

7. Shantaram, H. (1957), " The extension of larval duration in *Trogoderma granarium* Everts after DDT treatment," *Proc. Nat. Inst. Sci. Ind.*, **23 B**, (5 and 6), 145–51.

A prolonged larval duration is observed in a proportion of the grubs of *Trogoderma granarium* surviving DDT treatment. The proportion of ' late-pupating ' larvæ is higher in the insecticide-treated batches than in the untreated batches. While larval life is prolonged, no such effect is observed on the pupal duration or on the duration of imaginal life of the survivors following DDT treatment.

(D. V. M.)

8. Puttarudriah, M. and Channabasavanna, G. P. (1958), "Preliminary acaricidal tests against the areca mite, *Raoiella indica* Hirst," *Arecanut Jour.*, **8** (4), 87–88.

"Pestox 3 H," "Systox," "Solbar" and "Wettable Sulphur" are all found to be efficient acaricides against *Raoiella indica* Hirst on arecanut, but "Wettable Sulphur" is recommended for general use both on account of its cheapness as well as residual efficacy.

(D. V. M.)

9. Seshagiri Rao, D. (1957), "The insecticidal property of several common plants of India," *Economic Botany*, II, **3**, 274–76.

Investigations by the author on the effect of spraying extracts of petals of several species of flowers against the rice weevil, *Sitophilus oryzæ* L., have shown that a number of them possess insecticidal properties equivalent to or better than that of 11% pyrethrum extract.

(D. V. M.)

AGRICULTURAL CHEMISTRY

1. Venkatarao, B. V. and Govindarajan, S. V. (1956), "Application of high levels of Phosphates to red soils—Studies on their effect on Phosphorus status and crops yeilds," *Proceedings of the National Academy of Sciences* (India), Allahabad, **25**, Section A, Part 5, pp. 369–75.

Increasing doses of phosphoric acid from 0 to 160 lb. P_2O_5 per acre were applied to a red sandy loam in six successive seasons and the influence of these applications on the crop yield, uptake of N and P_2O_5 by the crop and distribution of the citric soluble and total P_2O_5 in the soil studied. Increases in the yield of Ragi are significant up to the 40 lb. P_2O_5/acre levels, while further increases do not show response in crop yield. The total uptake of N by the crop appears to be influenced by the phosphate applications, this being largely due to uptake by the straw. Application of 40 lb. P_2O_5/acre doubles the citric soluble P_2O_5 originally present in the soil and further increased applications do not increase this to any large extent.

(B. V. V. R.)

2. Khan, A. R. and Mathur, B. P. (1957), "Effect of burrying sannhemp as green manure on the yield of wheat," *The Indian Journal of Agricultural Science*, 1957, **27**, Part 2.

Correct intervals between sowing of green manure, its burying under and sowing of wheat crop succeeding it form the technique in green manuring. If properly done this would furnish an additional return of about 5 mds. grain and 15 mds. straw which might offset the so-called loss of one crop season. Application of phosphate in conjunction with green manure is profitable.

(K. SHANKAR)

3. Sen, A., Rewari, R. B., Pandey, S. L. (1957), "Ammonia content of some Indian soils in relation to their reaction and hygroscopic moisture," *Journal of the Indian Society of Soil Science*, **5**, No. (2), pp. 109–16.

The NH_3–N content of 215 air-dry surface soils increased with increase in moisture and decreased with increase in soil reaction. The relationship could be expressed in the form $Y = 3 \cdot 70 + 1 \cdot 66\, X_1 - 0 \cdot 42\, X_2$. Where $Y = NH_3$–N in mg.%, X_1 hygroscopic Moisture % and $X\,2 =$ P.H. of the soil.

(K. SHANKAR)

4. Bhattacharjee, J. C. (1957), "Erosion study in laterite area of West Bengal," *Ibid.*, pp. 103–108.

A detailed plot-to-plot erosion studies on a 5,000 acre land were made. Climate, relief, vegetation and soil characteristics were found to be conducive to soil erosion. Erosion is mainly due to the agency of water. Erosion ratio calculated as Dispersion ratio/Colloid; Moisture equivalent, has been found to be affected by the clay contents, ore-spaces, etc., to marked extent. A few remedial measures are suggested.

(K. SHANKAR)

5. Ahamed Bavappa, K. V. and Hanumantha Rao, K. (1957), "A note on some tropical green manure plants for the west coast," *Madras Agricultural Journal*, **44**, pp. 287–89.

Tephrosia noctiflora was highly drought-resistant and withstood water-logging better than *T. Purpurea*. *Phaselous semierectus* withstood water-logging and was fairly drought-resistant. *Indigofera hirsuta* and *Cassia leschenaustiana* withstood water-logging fairly well. *Crotalaria anagyroides* and *C. gorcensis* would not tolerate water-logging.

(K. SHANKAR)

6. Guttay, J. R., Stritzel, J. A. (1957), "Treatment of Corn seed with Phosphate," *Agronomy Journal*, **49**, (2).

The weight of young corn plants in soil cultures in the green-house was found to increase with the content of P present naturally in the

seed independently of seed weight. In field experiments supplementation of natural P content of each seed with 6 mg. of P as $NaH_2PO_4H_2O$ applied in glue coating resulted in an average corn yield 4·5 bushels per acre above that produced from seed treated with glue alone.

(K. SHANKAR)

7. Venkatarao, B. V. and Govindarajan, S. V. (1958), "Liquid ammonia as a fertilizer—some soil studies on nitrogen transformations," *Proceedings of the National Academy of Sciences* (India), Allahabad, **24 A**, Part 4.

In this paper results of some preliminary chemicals studied on the use of liquid ammonia as fertiliser for crops is reported. The mechanism of injection of liquid ammonia in the soil and the losses of ammonia occurring at the soil surface are discussed. It is found that ammonia is not immediately fixed into exchange complex but remains in a free state for one or two weeks after injection. The nitrification of ammonia is more rapid than ammonium sulphate. The losses of ammonia due to escape at the soil surface is found to be less than 1% of the quantity injected at depth into soil.

(B. V. V. R.)

Research in Progress

At the Agricultural Research Station, Alnawar, the standing crop of Sugarcane (1957–58) was harvested. In the varietal trials with six varieties of sugarcane the varieties Co. 678 and Co. 740 gave higher yields than Co. 419. The quality of *gur* (jaggery) prepared out of Co. 740 was also better than others.

At the Agricultural Research Station, Nippani, selection in village bulk material of tobacco was continued. In the crosses and back-crosses of *S*-20, *Yali* and *Charothar*, 63 selections were made. About 486 lb. of seed of the improved strain *S*–20 is ready for distribution.

Application of potassic fertilisers appeared not to contribute as much increase in yield of *Bidi* tobacco as compared to application of nitrogen. Indications are that deep placement of fertilisers show a tendency to increase tobacco yields.

At the Botany Section of the College of Agriculture, Dharwar, selections from the hybrid material between *Solanum melongena* and *Solanum xanthocarpum* have been made and are found to be resistant to Shoot-borer under field conditions, besides possessing all other desirable qualities of the cultivated brinjal (*S. melongena*).

Polyploidy has been induced in gram and chillies by treating with colchicine.

Selections have also been made from the hybrid material between *Hibiscus cannabinus* and *Hibiscus sabdariffa*, keeping in view the desirable qualities of jelly making of the calyx, non-branching habit and improved fibre qualities.

At the Agricultural Research Station, Bijapur, plant breeding work on Jawar, Gram, Linseed, Bajra, Safflower, Groundnut, Mung and Tur is in progress. In the agronomical trials carried out at the above Station it has been found that 4 lb. of seed would be ample per acre for *Rabi* jawar when a spacing of 18″ is adopted. Sowing in the middle of October is found to give satisfactory yield of wheat at 30 lb. of seed per acre to be optimum. Application of manganese at 6 lb. per acre is found to enhance groundnut yields.

In the Division of Agricultural Chemistry at Bangalore, the main items of work in progress during the Quarter were:—

1. Studies on application of high levels of phosphate to red soils with a view to improve their fertility: Red soil typical of the area round

about Bangalore is isolated in plots in the potculture house and are subjected to application of heavy doses of phosphate repeated over a number of seasons. The soil phosphorus has been doubled in some of the treatments. The plots are cropped with ragi to ascertain the fertility trends. The trend of results in these studies indicate that it is possible to improve the productivity of red soils by increasing their phosphorous status.

2. An experiment to ascertain the optimum time of application of ammonium sulphate-nitrate, a new nitrogenous fertiliser material to paddy, is in progress for the past two seasons. The material is compared with ammonium sulphate whose value as a source of nitrogen for paddy is well established. Preliminary indications are that the split dose of applying nitrogen at present practised, namely half at planting and half at first weeding, could be employed in the case of ammonium sulphate-nitrate also. Further investigations are in progress.

3. Experiments to ascertain the need of potash for paddy and ragi are in progress for the past few years. While the response of paddy to potash has not been positive, the plot experiments in the potculture house has shown that ragi responds to combined application of all the nutrient elements and there is definite response to potash when applied along with nitrogen and phosphorus. The data from the field experiments are awaited.

4. Field experiments to ascertain the influence of application of phosphate along with green leaf manure to paddy on the utilisation of the added phosphate has been in progress for the past three years. It is generally indicated that better crop returns are obtained to applications of phosphate in the presence of green manure rather than in its absence. Such an effect is found to be more pronounced in calcareous soils. The results of the monsoon experiments are under examination.

5. Experiments conducted on paddy and ragi on the effect of application of phosphate composted with farm-yard manure has given beneficial results in the shape of increased yields of grain and straw. It is programmed to extend the trials on this mode of application of phosphatic fertilisers to other crops also.

6. Studies to critically evaluate the new nitrogenous and phosphatic fertiliser materials such as urea, chilean nitrate, dicalcium phosphate, kotka phosphate for various crops are also in progress.

The Division has been conducting studies on specific schemes sponsored by the I.C.A.R. and other agencies under the Second Five-Year Plan.

A scheme to study the cause of *Hidimundige roga* on areca has been in progress for an year. Studies to evolve suitable remedial measures are being conducted. Preliminary survey on the incidence of the disease has been carried out. The work is in progress.

A scheme to try out the effect of various fertiliser material on cultivators' fields in the several districts of the State was put into operation during the Quarter. Preliminary arrangements for conduct of the trials during the next crop season has been made and some experiments during *rabi* season have been started at Shimoga Centre.

A scheme to survey the areas susceptible to soil erosion and also conduct studies on the extent of run-off by constructive run-off cisterns in typical areas was sanctioned during the latter part of the Quarter. Preparation for starting of the said studies are in progress and work will be taken up soon.

The analytical part of the work pertaining to the studies on powdery mildew on tobacco and cotton physiological scheme has been in progress according to schedule.

—(D. V. M.)

News and Notes

Sri. M. L. N. Iyengar, till recently Technical Assistant to the Director of Agriculture in Mysore, Bangalore and Editor, *Mysore Agricultural Journal*, has been appointed as Farm Radio Officer, Indian Council of Agricultural Research, New Delhi. Sri. Iyengar had taken over the Editorial responsibility of the Journal from August 1953 and spared no efforts in making it popular both amongst the Agricultural Research workers and cultivators. We wish him all success in his new post.

Dr. B. Dasappa, Retired Deputy Director of Agriculture and who was formerly Treasurer and Chairman, Editorial Committee of the Mysore Farmers' Forum, has been appointed as Additional Assistant Agricultural Commissioner, Indian Council of Agricultural Research, New Delhi.

Sri. R. S. Iyengar, In-charge Professor of Agriculture, Mysore Agricultural College, Hebbal, retired from service with effect from 1–4–1958. Practically throughout his service he was connected with the Mysore Agricultural School and College and was a very popular lecturer. He had made a thorough study of the crops in old Mysore State and has contributed a number of articles to this journal. The staff and students of the Mysore Agricultural School and College bade him farewell at a special function arranged in the College premises on 4–4–1958.

Sri. Dwarakinath, Principal, Extension Training Centre, Mandya, has been appointed as the Assistant Professor of Agriculture, Mysore Agricultural College, in place of Sri. R. S. Iyengar.

Sri. R. Narasimiah, Vice-President, Mysore Young Farmers' Forum, visited Ceylon from 29–9–1957 to 19–12–1957 in connection with Leadership Training in Rural Development at the Centre for Advanced Training, Aloka, Bandagama, Ceylon.

The 4th Annual Convention of All-India Farmers' Forum was held at New Delhi from 14–3–1958 to 19–3–1958. The following gentlemen among others from the State participated in the function:—

Sriyuts:

(1) T. R. Nesvi.
(2) V. Masiyappa.
(3) L. T. Karle.
(4) Kantarao Desai.
(5) R. Narasimiah.
(6) M. Vasudevamurthy
and (7) S. V. Haridas.

The Departmental Research Council has been reconstituted with the following as members:—

1. The Director of Agriculture and Commissioner for Food Production (*Chairman*).
2. Principals, Agricultural Colleges, Hebbal and Dharwar.
3. Agricultural Chemist.
4. Government Entomologist.
5. Government Plant Pathologist.
6. Agricultural Engineer.
7. Economic Botanist.
8. Deputy Directors of Agriculture of all Divisions.
9. State Statistician.
10. Horticulturist, Gonicoppal.
11. Soil Conservation Officer and
12. Joint Entomologist (*Secretary*).

The 2nd State Agricultural Seminar was held at Hassan from 22–2–1958 to 24–2–1958 under the Presidentship of Sri. H. S. Rudrappa, Minister for Agriculture. Dr. Punjab Rao Deshmukh, Minister for Co-operation, Government of India, inaugurated the Seminar which was also addressed by Dr. R. P. Lynton, Director, Centre for Advanced Training in Youth Leadership, Aloka, Ceylon.

The 25th Meeting of the Indian Central Sugarcane Committee, was held at New Delhi from 7th to 14th April 1958. A number of Research and Development Schemes pertaining to sugarcane in the reorganised State were approved by the Committee including the one pertaining to the establishment of a Main Sugarcane Research Station. Dr. H. R. Arakeri, formerly Sugarcane Specialist, Bombay State, and at present the Deputy Director of Agriculture, Bangalore, attended the meeting on behalf of the Department.

Miscellaneous

THESE FASCINATING INSECTS—4

By S. Usman*

Ant. Surgery.—It seems that large-sized species of *Camponotus* and *Messor* were employed in surgery by the Jews for stitching wounds. The edges of the wound were brought together and an ant was made to bite. The body of the ant was then clipped off, leaving the head and the powerful mandibles holding on to the skin.

* * *

Use of Maggots in Surgery.—The most interesting development that blowfly maggots were of distinct value in the treatment of chronic osteomyelitis in man was announced in 1931. Methods of producing sterile maggots were soon developed and maggot therapy came into vogue. Studies of the mechanism by which maggots cleared out nerotic tissue and stimulated healing led to the discovery of a number of compounds in the excretions of the maggots that are highly favourable to the healing of indolent sores. The first to be recognised was allantion. This was closely followed by urea, and later on, a third one, ammonium carbonate, was reported. These materials are all now made synthetically and are readily available for use in alleviating sufferings of man.

* * *

Bee Sting Therapy for Arthritis and Neuritis.—Generally it is stated that bee stings will cure rheumatism. Some experimental proof exists that this is true.

Philip Terc, a noted Austrian practitioner, was the most outstanding champion of bee venom therapy in Europe. Dr. Terc suffered from an obstinate case of rheumatism. He was accidentally stung by a number of bees, after which his rheumatism symptoms disappeared. Thereafter he treated several cases of neuralgia, arthritis and rheumatism, and was convinced of a radical and permanent cure with bee stings, except where ossification had taken place. In 1912, Terc's son, a noted eye surgeon himself, published the results of 660 cases of arthritis and related forms that his father had treated with bee stings over a period of 40 years. The results were: cured 544, improved 99, unimproved 17.

Dr. Bodag F. Beck of New York City was the leading exponent of bee therapy in the United States. He claimed to be successful in 80 per

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cent. of his cases. Until 1933 he used prepared venom; later he used living bees.

Recently F. E. Guyton, Albama Polytechnic Institute, Auburn, treated six patients with bee stings for arthritis or neuritis. It is reported that three cases showed complete recovery, and the other three showed improved conditions but were not completely cured. Three cases out of six developed supersensitiveness to bee stings which, Dr. Guyton believes, were due to faulty technique of applying the stings.

[Abstracted from *Introduction to Entomology*, Agra University Press, and *Journal Economic Entomology*, **33** (1), 58–65 and **40** (4), 469–72.]

(Received: 3rd March 1958)

642-58 Printed at The Bangalore Press, Bangalore City, by C. Vasudeva Rao, Superintendent
edited by Dr. H. R. Arakeri and published by Secretary, Mysore Farmers' Forum, Cenotaph Road, Bangalore-2

STATEMENT ABOUT OWNERSHIP OF THE MYSORE AGRICULTURAL JOURNAL

[*Rule* 8, *Form IV—Newspaper* (*Central*) *Rules*, 1956]

1.	Place of Publication	..	BANGALORE.
2.	Periodicity of Publication		QUARTERLY.
3.	Printer's Name	..	BANGALORE PRESS.
	Nationality	..	LIMITED CONCERN.
	Address	..	BANGALORE PRESS, MYSORE ROAD, BANGALORE-2.
4.	Publisher's Name	..	MYSORE VYAVASAYA SANGHA, (MYSORE FARMERS' FORUM).
	Nationality	..	ORGANISATION.
	Address	..	CENOTAPH ROAD, BANGALORE-2.
5.	Editor's Name	..	DR. H. R. ARAKERI.
	Nationality	..	INDIAN.
	Address	..	DEPUTY DIRECTOR OF AGRICULTURE, BANGALORE DIVISION, SESHADRI ROAD, BANGALORE-1.
6.	Name and Address of Individuals Who Own the Paper		MYSORE VYAVASAYA SANGHA, (MYSORE FARMERS' FORUM), CENOTAPH ROAD, BANGALORE-2.

I, S. V. Haridas, Secretary, Mysore Vyavasaya Sangha, hereby declare that the particulars given above are true to the best of my knowledge and belief.

S. V. HARIDAS,
Secretary, Mysore Vyavasaya Sangha,
(Mysore Farmers' Forum).

BANGALORE,
31st March 1958.